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# CANADIAN PATENT

## PRODUCTION OF HOLLOW BODIES BY PRESSING

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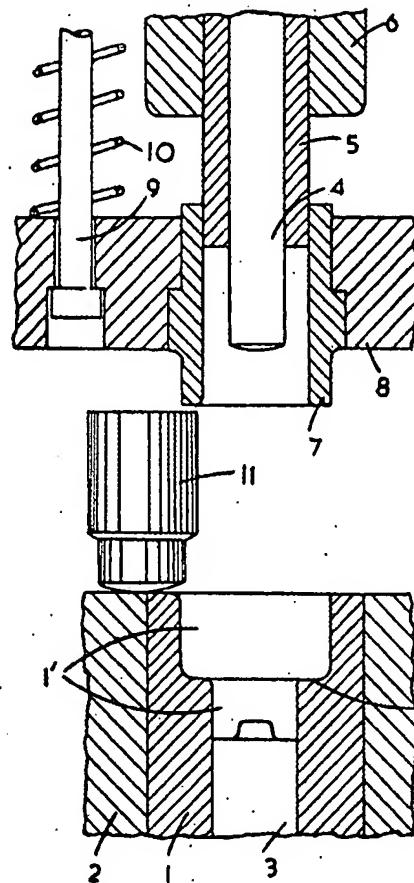


FIG.1.

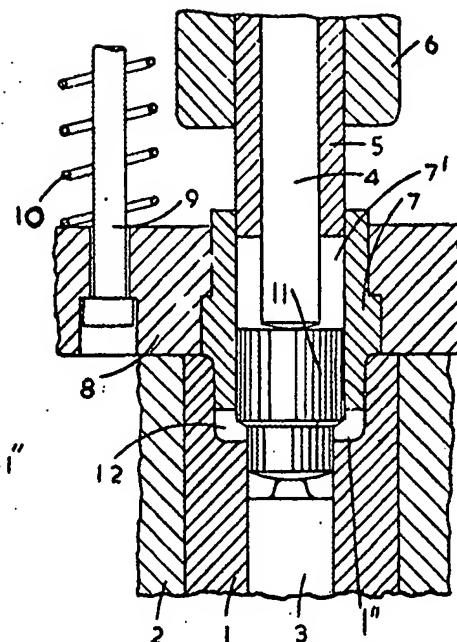


FIG.2.

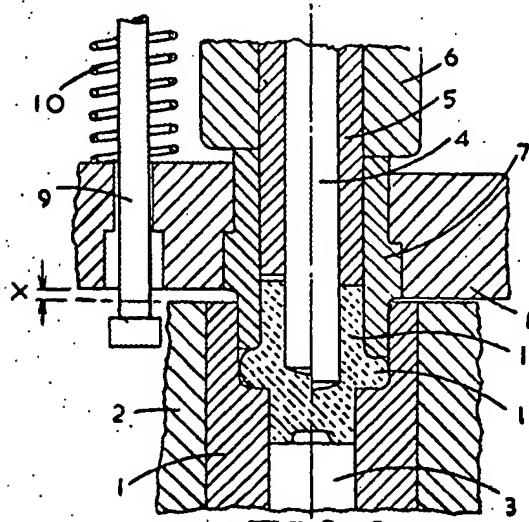


FIG.3.

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The invention relates to a method and apparatus for the production by cold pressing of hollow bodies of steel or other metal having an external flange, preferably of steel, as a result of deformation without removal of metal.

Such hollow bodies have hitherto been made in a number of successive pressing operations, usually with the interposition of annealing. This method is very troublesome, time-consuming, and expensive.

The method according to the invention makes it possible to produce hollow metal bodies with a flange as a result of the cold-deformation of a blank, more particularly of steel, in a single operation. By giving an appropriate form to the tool which is used for carrying out the new method, the flange on the cold-pressed hollow body can be given any desired shape and position.

According to the invention the method broadly includes the steps of placing the blank in a die provided with a radial or lateral recess, causing the central portion of a stepped punch, during an initial portion of the single pressing operation, to engage a central portion of the adjacent end face of the blank and, by penetrating into, or through it axially, simultaneously to displace a part of the material of the blank into the die recess and another part of the material backwardly into an annular space between the central portion of the punch and the die, whereby to provide the blank with a roughly formed flange on its exterior and with an axially-directed annular wall about its said adjacent face, and then, during a final portion of the single pressing operation, to cause an annular punch, forming an end wall of the recess, to engage the outer end of the annular wall of the

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blank to force the material into final forming contact with the wall of the said recess.

According to another aspect of the invention the method includes the steps of placing the blank in a die adapted closely to receive the inserted end of the blank but having an outer end of greater diameter than the blank, causing an annular punch, during an initial portion of the single pressing operation, to enter the annular space between the outer end of the die and the blank to define an end wall of an annular recess around the blank, and then, during an ensuing portion of the single pressing operation, causing the central portion of a stepped punch to engage a central portion of the adjacent end face of the blank end, by penetrating into, or through it axially, simultaneously to displace a part of the material of the blank radially into the recess, whereby to provide the blank with a roughly formed flange on its exterior, and axially into an annular space between the annular punch and the central portion of the stepped punch, whereby to form an axially-directed wall about the said adjacent face of the blank, and then, during a final portion of the single pressing operation, to cause the adjacent end of the annular punch, and the step of the stepped punch, to force the material into final forming contact with the wall of the said recess.

A tool for carrying out the invention comprises a one-piece die, an annular punch which is adapted to be moved into the end of an annular space formed between an inserted blank end and the adjacent wall of the die so as to close this space and form an end wall of an annular recess, and a perforating punch, the latter being stepped and having

a central portion which is adapted to be forced axially against the middle of the blank to penetrate or perforate it axially so as to displace material into the annular recess to form a flange on the blank, and into an annular space between the annular punch and the central portion of the perforating punch whereby to form an axially-directed annular wall on the blank, the arrangement being such that the annular punch and the step of the perforating punch force the material into final forming contact with the walls of the annular recess, and that after the withdrawal of the annular punch from the one-piece die the flanged hollow body can be removed from the die by pushing it out of one end.

One way of carrying the invention into effect is illustrated, by way of example, in the accompanying drawings, 15 in which:-

Figure 1 is a cross-section through an example of a tool for carrying out the method of the invention, suitable for use in a single-acting press and with the parts shown in an initial position;

20 Figure 2 is a similar view of the tool as it is at the beginning of the pressing operation;

Figure 3 is a similar view but showing the parts in two different stages of the pressing operation.

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Referring to the drawings, 1 indicates the one-piece (i.e. unsplit or undivided) die which is secured in the reinforcement 2; the stepped bore 1' of the die being closed at the bottom by the counter-punch or end-support 3. The reinforced die 1 is secured in a known manner on the table of the press. The press-tool further consists of a punch 4, which is disposed axially in the press and serves for the perforation of the blank 11 inserted in the die, and an annular punch 7. The punch 4 is mounted in a bush 5 and secured together with the latter in the head 6 of the press. The bush 5 and punch 4 form a stepped press punch. The punch 4 is guided by means of the bush 5 in the annular punch 7. The annular punch 7 is secured within the plate 8 and moreover is so made and arranged that during the pressing operation it closes the opening of the die, i.e. the annular space formed between the wall of the die and the upper part of the inserted blank 11. The annular space 12 (Figure 2) remaining between the shoulder 1" of the die and the end face of the annular punch 7 serves for the reception of the blank metal for the formation of an outer flange 11', as may be seen from Figure 3. The carrier 8 of the annular punch 7 is connected, by means of studs 9 with the interposition of compression springs 10, to the head 6 of the press. By reason of the fact that the punch 4, which serves for effecting perforation, is guided in the annular punch 7 by means of the sleeve or bush 5 which receives it, an annular space 7' is formed above the inserted blanks 11, in which space a part of the material of the blank can rise axially during the pressing

1 operation.

The above-described press-tool operates as follows:-

5 A blank is inserted into the one-piece die 1, the blank being in the form of a section of rod or bar or of a stepped rough pressing 11, as is illustrated in Figures 1 and 2. On the downward movement of the head 6 of the press, the punch 4, 5 and the punch 7 are carried down until the carrier 8 of the annular  
10 punch 7 comes on to the die 1, as is illustrated in Figure 2. In this position of the parts, the annular punch 7 is disposed in the annular space between the blank 11 and the wall of the die, so that the annular space 12 which serves for the formation of the flange 11' is closed at the top. The actual pressing operation begins with further downward movement of the head 6 of the press, the punch 4, which with the brush 5 is now driven alone, engaging the middle area of the blank 11 and, as a result of perforating it, displaces  
15 the material radially and axially into the annular spaces 7' and 12 and against the counter-punch 3. The blank then assumes the form to be seen from the left-hand half of Figure 3, in which it is shown with the flange 11' roughly formed and with an axially-directed annular wall. As soon as the annular space 12 is to some extent filled by material, the annular punch 7 with its carrier 8 is raised, shortly before the end of the working stroke of the punch 4, as a result of the further radial displacement of material, by the  
20  
25

1 amount indicated at X, the springs 10 being compressed.  
The head 6 of the press then comes against the upper  
end face of the annular punch 7, which now receives  
from the head of the press a downwardly-directed  
5 pressure. As a result of this, and of the final portion  
of the movement of the punch 4 and brush 5, the  
radially-displaced material in the annular spaces 7'  
and 12 is forced to fill these spaces completely, so  
that the flange is given the desired final shape with  
10 certainty. The finished-pressed hollow body with its  
flange may be removed from the die 1 by pushing it  
out of one end by means of the counter-punch 3.

15 By means of the press-tool according to  
the invention there may be formed, by a single cold  
pressing operation, hollow metal bodies having a  
flange at the lower end (bottom) of which is provided an  
extension of any desired formation.

20 The method described makes possible an economical  
mass production of hollow bodies of any desired shape  
having an external flange, especially from steel, as  
a result of cold-forming in a single working operation.  
As a result of appropriate formation of the die 1 and  
25 of the annular punch 7, the flange 11' can be provided  
as desired at the top, at the bottom or in the middle  
of the hollow body.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:-

- 1        1. A method of making a hollow body, having an external flange, by a single cold-pressing operation on a blank of steel or other metal, which includes the steps of placing the blank in a die provided with a lateral recess, causing the central portion of a stepped punch, during an initial portion of the single pressing operation, to engage a central portion of the adjacent end face of the blank and, by penetrating into it axially, simultaneously to displace a part of the material of the blank into the die recess and another part of the material backwardly into an annular space between the central portion of the punch and the die, whereby to provide the blank with a roughly formed flange on its exterior and with an axially-directed annular wall about its said adjacent face, and then, during a final portion of the single pressing operation, to cause an annular punch, forming an end wall of the recess, to engage the outer end of the annular wall of the blank to force the material into final forming contact with the wall of the said recess.

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1           2. A method of making a hollow body, having an  
2         external flange, by a single cold-pressing operation on  
3         a blank of steel or other metal, which includes the steps  
4         of placing the blank in a die adapted closely to receive  
5         the inserted end of the blank but having an outer end of  
6         greater diameter than the blank, causing an annular punch  
7         during an initial portion of the single pressing operation,  
8         to enter the annular space between the outer end of the die  
9         and the blank to define an end wall of an annular recess  
10        around the blank, and then, during an ensuing portion of  
11        the single pressing operation, causing the central portion  
12        of a stepped punch to engage a central portion of the  
13        adjacent end face of the blank and, by penetrating into it  
14        axially, simultaneously to displace a part of the material  
15        of the blank radially into the recess, whereby to provide  
16        the blank with a roughly formed flange on its exterior, and  
17        axially into an annular space between the annular punch and  
18        the central portion of the stepped punch, whereby to form  
19        an axially-directed wall about the said adjacent face of the  
20        blank, and then, during a final portion of the single  
21        pressing operation, to cause the adjacent end of the annular  
22        punch, and the step of the stepped punch, to force the  
23        material into final forming contact with the wall of the  
24        said recess.

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1       3. A tool, for making a hollow body, having an  
2       external flange, by a single cold-pressing operation on  
3       a blank of steel or other metal, comprising a one-piece  
4       die, an annular punch which is adapted to be moved into  
5       the end of an annular space formed between an inserted  
6       blank and the adjacent wall of the die so as to close this  
7       space and form an end wall of an annular recess, and a  
8       perforating punch, the latter being stepped and having a  
9       central portion which is adapted to be forced axially  
10      against the middle of the blank to penetrate or perforate  
11      it axially so as to displace material into the annular  
12      recess to form the flange on the blank, and into an annular  
13      space between the annular punch and the central portion of  
14      the perforating punch whereby to form an axially-directed  
15      annular wall on the blank, the arrangement being such that  
16      the annular punch and the step of the perforating punch  
17      force the material into final forming contact with the  
18      walls of the annular recess, and that after the withdrawal  
19      of the annular punch from the one-piece die, the flanged  
20      hollow body can be removed from the die by pushing it out  
21      of one end.

1       4. A tool according to Claim 3, in which the  
2       annular punch is first adapted to be moved in advance of the  
3       perforating punch but is arrested by a stop or the like  
4       after it has entered the annular space between the blank  
5       and the wall of the die, while leaving the perforating punch  
6       able to continue its movement.

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5. A tool according to Claim 4, in which the perforating punch and the annular punch are so connected together by means of springs that after the annular punch has come into contact with the die, the perforating punch is able to continue moving alone against the action of the springs.

6. A tool according to Claim 5 in which the springs are such that the annular punch is adapted to be moved back by a short distance in the axial direction shortly before the end of the stroke of the press by the material which has been radially displaced into that space, and is then again moved forward with the perforating punch towards the end of the stroke to give the flange its final form.

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